THE SPATIAL DIMENSIONS OF INNOVATION IN THE LONDON METROPOLITAN REGION

Dr. James Simmie, Professor Peter Wood, James Sennett (University College London)

Dr. Douglas Hart (University of Reading)

"Regional Cohesion and Competitiveness in 21st Century Europe", the 39th European Congress of the Regional Science Association, Dublin, Ireland on 23-27 August 1999.

Introduction

This paper arises from work in progress on a comparative study of innovation in the London Metropolitan Region (LMR), and four other European cities characterised by high concentrations of R&D expenditures. A common questionnaire has been used in all five cities. This has been administered to a common sample frame of innovative companies who have won awards for Basic research in Industrial technologies for Europe (BRITE). In addition to this common sample frame, innovative firms drawn from local databases have also been interviewed. Around 35 firms have been interviewed in each city. The objective of this exercise is to produce a total sample of about 150 firms for detailed comparative analyses.

At the time of writing the European cities research had not been completed. The analyses presented in this paper are therefore based on preliminary findings from London only and secondary sources such as the Community Innovation Survey (CIS) results for 1998, employment statistics gathered from the National Online Manpower Information System (NOMIS) for 1995, workforce qualifications from the 2% Sample of Anonomysed Records (SAR) from the 1991 Census and the interviewed sample of BRITE and London Manufacturing Group innovative firms.

The arguments deployed start from the empirical observation that innovations and innovative firms are disproportionately concentrated in a minority of urban regions. The first task of the research is to seek to disentangle and unpack the various competing explanations of why innovation is concentrated in these particular cities. Some order is imposed on this complex task by seeking to relate the nature of innovation processes themselves to the possible reasons that provide innovative firms with advantages by locating in some agglomerations rather than others.

It is argued that one of the key problems for innovators is to minimise the uncertainties and risks associated with the development and sale of new products and services. Agglomeration economies may help to keep uncertainties within acceptable bounds in four main ways.

1. Internal to the firm. Examples include the ability to specialise because of the recruitment of in-house management, technical and professional expertise.

2. External to the firm but internal to the industry, known as localisation effects. Examples here include the importance of proximity and the significance of clusters and networks.

3. External to the firm but internal to the urban region, known as urbanisation effects. Examples include the size of local markets, transportation and communication infrastructures, commercial and public social, cultural and leisure facilities.

4. External to the firm and to the urban area. These may be called globalisation effects. They include international suppliers, competitors and markets.

The contributions of each of these different types of agglomeration economies to the reduction of uncertainty are analysed in turn. It is concluded that the LMR makes distinctive contributions to the reduction of innovation uncertainty in all four ways. Nevertheless, its most important contributions seem to associated with firms' internal characteristics, urbanisation and globalisation effects rather than the more commonly believed localisation effects.

The spatial concentration of innovation

The spatial concentration of innovative firms is marked throughout Europe. The CIS is beginning to provide regular and reasonably consistent data to demonstrate this descriptive fact. For the first time in 1998 it provided usable data for the United Kingdom (UK). From this it is possible to identify the most innovative manufacturing and marketed services sectors in the UK. These are listed in Table 2. The selection criterion used was that the most innovative sectors are those in which more than 50% of firms, in the sample of 1,596, had introduced a new product or service on to the market between 1994 and 1996.

Table 1 shows the numbers and proportions of such firms located in the LMR. For data availability reasons, the LMR is broken down in to three areas, Greater London, together with the new South East and Eastern regions. Table 1 shows that, among the firms claiming to have introduced innovations during the 1994-96 period, a majority in the LMR came from the most innovative and often high-tech sectors. This was particularly true in the rest of the South East (ROSE) where some 57% and 56% of the most innovative firms were also engaged in high-tech production in the South East and Eastern regions respectively.

Table 1 also shows the beginnings of a fairly consistent contrast between Greater London and ROSE that will be reiterated below. This contrast is that Greater London does not usually perform as well as the ROSE in terms of innovation. Some 45% of the firms in this CIS sample, for example, were in less innovative sectors compared with only 24% for the South East and 10% for the Eastern region.

These CIS data are reflected in the numbers and proportions of employment in innovative sectors in the LMR in 1995. Table 2 lists all the CIS identified most innovative sectors together with the employment in them for Greater London and the ROSE in 1995. By that year total manufacturing employment had shrunk to just 8.8% of total employment in Greater London compared with 16.4% in the ROSE. Total employment in the most innovative and high-tech sectors in the ROSE (6.1%) was nearly three times the proportion of that in Greater London (1.9%). Similarly the proportions of the remaining most innovative sectors were 6.1% in the ROSE and 2.5% in Greater London.

Nevertheless, the proportions of employment in the most innovative manufacturing sectors compared with total manufacturing employment are high in both Greater London and the ROSE. In Greater London half (4.4%) of total manufacturing employment (8.8%) is in the most innovative sectors. In the ROSE the proportion is even higher at 12.2% out of a total of 16.4% of total employment in the area.

Table 1: Innovative and high-tech firms in London, South East and Eatern regions, 1998

Innovating sectors	High-tech	NACE Rev 1	Greater London	South East	East
Most innovative and high-tech sectors			Numbers in sample		
Chemicals & chemical products	HT	24	1	14	9
Rubber & plastic products	HT	25	1	14	3
Office accounting & computers	HT	30	1	14	2
Electrical machinery	HT	31	6	4	4
Electronic equipment	HT	32	2	12	8
Medical, precision & optical	HT	33	5	17	14
Other transport equipment	HT?	35	1	6	4
Most innovative and high-tech sectors %			33	57	56
Other most innovative sectors					
Food products & beverages		15	5	6	7
Textiles		16	0	1	0
Leather products & footwear		19	1	2	1
Non-metallic mineral products		26	0	2	1
Fabricated metal products		28	1	4	3
Machiner y		29	4	8	8
Motor vehicles		34	0	4	6
Other most innovative sectors %			22	19	33
Less innovative sectors			Numbers in sample		
Other manufacturing sectors nos.			23	34	8
Less innovative sectors %			45	24	10
Total N = 100%			51	142	78

Note: Most innovative sectors are those in which > 50% of firms introduced new products between 1994-96 drawn from a sample of 1596 firms.
Source: CIS (forthcoming)

It is not possible to make exactly the same comparisons for services because all public services are excluded from the CIS survey. Nevertheless, Tables 2a and 2b show that innovative service employees form greater proportions of total employment than do innovative manufacturing workers. In the case of innovative but not so high-tech employees there are more of those (9.6%) in Greater London than total

manufacturing employees (8.8%). Altogether innovative service employees constitute some 14.8% of total employees in Greater London.

There are concentrations of service employees in the ROSE as well. Some 11.4% of total employment there in 1995 consisted of jobs in the most innovative sectors identified in the CIS.

To summarise these figures briefly, there are spatial concentrations of the most innovative firms and their employees in Greater London and the ROSE. There are greater proportions of innovative and high-tech manufacturing firms in the latter. Thereare relatively more innovative but not necessarily high-tech service firms in Greater London.

Table 2a: Employment in innovative manufacturing sectors, London Region, 1995

Innovating sectors Manufacturing Most innovative and high-tech sectors		NACE Rev 1	Greater Numbers	London %
Chemicals & chemical products	HT	24	16,641	0.5
Rubber & plastic products	HT	25	9,600	0.3
Office accounting & computers	HT	30	4,499	0.1
Electrical machinery	HT	31	11,092	0.4
Electronic equipment	HT	32	5,930	0.2
Medical, precision & optical	HT	33	10,836	0.3
Other transport equipment	HT?	35	2,633	0.1
Other most innovative sectors				
Food products & beverages		15	23,399	0.7
Textiles		16	455	<0.1
Leather products & footwear		19	3,136	0.1
Non-metallic mineral products		26	3,806	0.1
Fabricated metal products		28	20,641	0.7
Machinery		29	16,398	0.5
Motor vehicles		34	10,873	0.3
Sub-total most innovative & high-tech sectors			61,231	1.9
Sub-total other most innovative sectors			139,939	2.5
Sub-total less innovative sectors			140,161	4.4
Total manufacturing sectors			280,100	8.8

Table 2b: Employment in innovative service sectors, London Region, 1995

Marketed services					
Most innovative and high-tech sectors					
Post and telecommunications	HT	64		91,369	2.9
Computer and related activities	HT	72		61,467	1.9
Research and Development	HT	73		12,812	0.4
Other most innovative sectors					
Water transport		61		7,336	0.2
Financial intermediation		65		189,548	6
Insurance and pensions		66		34,465	1.1
Financial intermediation auxiliary		67		72,528	2.3
Sub-total most innovative & high-tech sectors				165,648	5.2
Sub-total other most innovative sectors				469,525	9.6
Sub-total less innovative service sectors				2,430,511	76.4
Total service sectors				3,065,684	91.2
Total employment all sectors				3,345,784	100
Proportion of Great Britain innovative sectors		4,548,770	22		18.4
Proportion of Great Britain all sectors		20,468,383			16.4

Source: Census of employment

Reasons for spatial concentrations of innovations

1 Internal firm dynamics

The reasons why innovative firms and employment are concentrated in the ways described above in the LMR are being examined from four related points of view. As outlined in the introduction, these include reasons internal to the firm, localisation, urbanisation and globalisation effects.

Although we are not investigating the internal dynamics of innovative firms it is assumed that some of these are significant in the context of why firms locate and stay in particular places. This assumption follows from certain key arguments in neo-Schumpeterian evolutionary theory. There it is argued that in the "real world" firms are confronted by constantly changing economic cycles driven by continuous competition and changing markets, uncertainty and imperfect information, the dynamic and unstable nature of economic growth and destruction and the significance of the contexts in which they operate. All of these factors are subject to change through time.

In such turbulent circumstances the key issue raised by neo-Schumpeterian evolutionary theory is the uncertainty confronting all firms. This arises primarily because the information they need is incomplete, fuzzy and costly. One of the main results of uncertainties arising from imperfect knowledge and information is that capitalist markets are trial and error processes in which some firms are successful and others fail. This is a dynamic process and leads to creative destruction in which new sectors are developed and succeed while others decline and fail.

These problems are most acute for firms trying to innovate, do new things and compete in global markets. One of the internal strategies adopted to overcome them is to specialise. Among other things this involves hiring in-house professional, technical, management, marketing and financial expertise. Progression down this path often leads firms to try to keep knowledge of strategic importance internal to the firm in order not to become dependent on others with respect to crucial assets. Moreover, collaborative development of new products means that firms have to share profits afterwards. This also mitigates against collaboration. R&D collaboration and technology transfer may therefore be less important than is often assumed in the literature and by policy makers (Teece 1998).

One advantage of keeping key innovation activities internal to the firm and hiring higher quality labour to deal with automation, planning, logistics and technology, is that the higher the level of in-house knowledge the more employees will be open to new developments and to introduce them to the company (Manshanden and Poot 1998). Taken together these kinds of internal firm strategies may be more common than is generally supposed in the literature. Such internal firm dynamics do not themselves necessarily lead to the spatial concentration of innovative firms. On the other hand they do lead to external demands that could have strong influences on the relative significance to innovative firms of different elements of localisation, urbanisation and globalisation effects.

The different nature of these demands are illustrated in Table 3. This shows the results of a factor analysis of innovative firm responses in the LMR to the question "If you were going to start a new firm to develop and exploit a new innovation, how important would the following characteristics of this region be in a decision to start here rather than another region altogether?" Respondents were given a list of 25 possible reasons for developing a new innovation in the LMR. In the analysis they were grouped in to seven factors accounting for 80.9% of total variance.

Table 3: Reasons for location of innovative firms in the London Region

Factor	Percent of variation	Location variable	Variable description	Factor score
2 Localisation effects, external to the firm but internal to the industry				
Factor 4	6.6			
		EXCOL208	Presence of ex-colleagues	0.87974
		FRIEN209	Presence of friends	0.85898
		HEIS207	Contributions from universities	0.61981
Factor 6	5.6	Effective time proximity to customers		
		CUSTS192	Proximity of customers	0.75689
Factor 7	5	Local industry suppliers		
		SUPPS193	Proximity of suppliers	0.60377
3 Urbanisation effects, external to the firm but internal to the urban area				
Factor 1	36.1	Regional transportation systems		
		APORT203	Good access to major airport	0.76597
		LONDO200	Good access to London	0.88445
		ROAD202	Good Access to national road network	0.87847
		TRAFF199	Low levels of traffic congestion	0.67525
		RAIL201	Good rail connections	0.83143
Factor 2	12.2	General and specialised business knowledge and information		
		BGEN188	Access to private general services	0.79194
		BSPEC189	Access to private specialised business services	0.7682
		PBUS196	Proximity of business services	0.77982
		PINFO197	Proximity of sources of information	0.83547
Factor 3	9.5	General financial and training knowledge and information		
		CAPIT198	Access to financial capital	0.7664
		LINKS206	Contributions from Business LINKS	0.85561
		TECS205	Contributions from TECS	0.72413
Factor 5	6	Availability of premises and professional labour		
		CPREM191	Cost of premises	0.6495
		PREMS190	Availability of suitable premises	0.79167
		PROFS186	Availability of professional experts to recruit	0.79874

Source: Responses to survey

2 Localisation effects

A frequently cited line of argument used to explain the concentration of given industries in particular cities is that standardised Fordist mass production techniques are being replaced by post-Fordist flexible specialisation (Piore and Sabel 1984; Harrison 1992; Benko and Lipietz 1992; Storper 1992). A result of this change is the vertical disintegration of large firms and the reconcentration of their contractual and networked parts in new industrial districts. The reason for this new agglomeration behaviour is to minimise the costs of transactions within the now networked industries. Both Marshall (1919) and Jacobs (1968) stress the advantages of proximity in these districts in order both to meet people and to gain unplanned information.

The result of such behaviour is also often argued to be the formation of industrial clusters. These may be said to have been formed when the following characteristics are present in a local industry:

* spatial and sectoral concentration of enterprises

* socio-cultural ties amongst local economic agents, creating a common code of behaviour

* intense vertical and horizontal linkages, based both on market and non-market exchanges of goods, services, information and people

* a network of public and private local institutions supporting the enterprises in the district

(see Rabellotti 1995).

There is some doubt, however, about the generality of such localisation effects. Research focusing on innovative firms and projects in core metropolitan areas suggests that local production networks do not make particularly significan contributions to innovation (Decoster and Tabaries 1986, Perrin 1988, Hart and Simmie 1998, Wiig and Wood 1996). Table 3 indicates that in the LMR there are some minority localisation effects. These include local industrial knowledge and experience embodied in the presence of friends and ex-work colleagues together with contributions from universities. There are also minority factors involving the proximity of local industry customers and suppliers.

Table 4 shows the mean scores given to these variables by the interviewed firms. They were asked to rate their importance to their location decisions on a scale of 1 to 5. All the scores are relatively low. The only exception is contributions from universities. This result, however, follows essentially from the nature of the sample frame used. Most of the firms acquiring BRITE awards needed university partners as an essential element of their bids for European funding.

The weakness of these localisation effects in the LMR may be because they are significant but only for a minority of innovative firms. A possible explanation for this is suggested by one of our Dutch colleagues, Walter Manshanden. He argues that industrial clustering is a trade-off between proximity and uncertainty. He has found that firms operating in certain markets were more innovative than firms operating in uncertain markets. His working definitions of these two types of markets are that one-off project production is less certain than continuous series production. In the Netherlands he found that firms selling to a series market tend to have a larger spatial scope and a higher level of innovation. He concludes that the need for proximity decreases as the certainty of the relationship increases. Conversely, proximity is necessary when uncertain transactions are involved.

Table 4: Importance of reasons for location of innovative firms in the London Metropolitan Region

		Mean score
2 Localisation effects, external to the firm but internal to the industry		
Factor 4	Local industrial knowledge and experience	1.81
	Presence of ex-colleagues	1.66
	Presence of friends	1.27
	Contributions from universities	2.5
Factor 6	Effective time proximity to customers	1.57
	Proximity of customers	1.57
Factor 7	Local industry suppliers	1.93
	Proximity of suppliers	1.93
3 Urbanisation effects, external to the firm but internal to the urban area		
Factor 1	Regional transportation systems	2.58
	Good access to major airport	3.03
	Good access to London	2.73
	Good Access to national road network	2.75
	Low levels of traffic congestion	2.07
	Good rail connections	2.33
Factor 2	General and specialised business knowledge and information	1.42
	Access to private general services	1.41
	Access to private specialised business services	1.44
	Proximity of business services	1.34
	Proximity of sources of information	1.5
Factor 3	General financial and training knowledge and information	1.36
	Access to financial capital	1.67
	Contributions from Business LINKS	1.27
	Contributions from TECS	1.13
Factor 5	Availability of premises and professional labour	3.23
	Cost of premises	3.1
	Availability of suitable premises	3.03
	Availability of professional experts to recruit	3.55

Source: Responses to survey

Tables 1 and 2 have already shown that many of the most innovative firms in the LMR are often selling to other businesses. These include defence procurement agencies, health and welfare institutions and other private businesses. These are essentially series markets. Business relationships have been built up over time. The products and services sold often embody high levels of professional and technical expertise. It is possibly the reduction of uncertainties in these circumstances that explains why the majority of innovative firms in the LMR do not often develop local industrial clusters with the characteristics outlined above.

Where such clusters have developed in the LMR they are often based on the more creative and craft industries. These do not appear in the CIS statistics as among the most innovative sectors. They include such seasonal or project based activities as fashion and clothing in the West End and inner East London, jewellery in Hatton Garden and Clerkenwell, and media in West London.

3 Urbanisation effects

The traditional explanation of why innovation is concentrated in core metropolitan regions is the product life-cycle model inspired by Vernon (1966). His seminal work relates different stages of product life-cycles to their location in space. He argued that during the first innovative stage in a product's life-cycle inventors and firms are most likely to be found in large metropolitan agglomerations. The main reasons for this are that the introduction of new innovative products is highly dependent on communication and external economies. Empirical work based on this explanation has examined unique locational factors, such as universities, airports, labour, venture capital and quality of life features, within specific areas, that are presumed to be required for innovative high technology development.

Traditional location theory also argues that transport costs are a decisive factor in location decisions. Table 3 shows that this is very much the case for innovative firms in the LMR. Factor 1 within the group of urbanisation effects consists of various elements of hard infrastructure which make up the regional transportation system. This accounts for 36% of the variation within the location variables.

Table 4 also shows that good access to a major airport has the highest mean score of this group of variables. This is an early indication of the importance of globalisation effects in core metropoilitan areas. The high proportions of innovations exported in to the advanced G7 economies make international linkages from business to governments and other foriegn companies critically important. International airports are a crucial piece of hard infrastructure enabling these linkages.

A further point should be noted concerning the importance of regional transportation systems. Their simple presence does not necessarily ensure "effective accessibility". Transportation connections across the ROSE involving journeys through Greater London are notoriously time consuming. The effective accessibility, particularly between West and East London, is poor. Nevertheless, one of the variables included in this group is "low levels of traffic congestion". This is not a feature generally associated with central London where long commutes to work and congestion costs are common. Work by Poot et al (1997) investigating the R&D friendliness of different areas by postal code in the Netherlands, has shown that the peripheries of urban areas are more R&D friendly than central cities or agricultural areas. This is reflected in the data shown in Tables 1 and 2. They show that the ROSE performs better than Greater London in most R&D based innovative and high-tech sectors. The location of these activities in the ROSE partially reflects the search for lower congestion costs.

In Table 3 two further groups of traditional urban assets are identified as significant in the locational decisions of innovative firms. Factors 3 and 5 indicate the continuing importance of premises (land), labour and capital. The concept of urban assets was developed by Coase (1937) and Williamson (1985) in transaction cost economics. Urban assets are defined as a necessary capital good or attribute of persons without which other production processes or transactions cannot proceed. In the case of innovation these are likely to be high quality labour, knowledge and information, the presence of top decision makers, a creative and entrepreneurial culture, and the kinds of environment/facilities that such highly paid labour and decision makers choose to live and work in.

It is also the case that production takes place in buildings. The relative significance attached to both the availability and cost of suitable premises in the LMR came as something of a surprise. Table 4 shows that both variables were scored highly by the interviewed firms. It indicates one of London's longstanding problems. This is the scarcity of suitable, modern manufacturing premises. This is partly the result of market forces and partly caused by restrictive planning regimes. The net result is the decentralisation of innovative manufacturing activities to the Western counties of the LMR. It will require further investigation in the second stage of the project.

The importance of high quality professional labour, on the other hand, was an expected finding. Table 4 shows that the availability of professional experts to recruit was rated more highly by respondents than any other single variable.

As long ago as the 1980s Oakey (1981) showed that the key urban asset in the innovative scientific instruments sector was knowledge embodied in labour. The geographic mobility of this type of labour was low. It was therefore a relatively permanent fixture in particular cities. It may be relatively mobile within those cities but this restricted geographic movement spatially confines its information and know-how transfers. They thus become an asset associated with a particular city region.

Table 5 shows the qualifications of the resident LMR workforce in 1991. It may be seen that for the highest levels of qualification, a and b, the LMR, and particularly inner London, possessed significantly higher levels than those found in the rest of Great Britain (GB). An examination of the subject groups of the highest achieved qualifications also reflects the types of innovative sectors found in the LMR. The ROSE contained higher than average proportions of technologists and engineers reflecting its specialisation in high-tech innovation. All areas, but particularly inner London, contained higher than average proportions of staff qualified in social, administrative and business subjects. Again this reflects their specialisation in innovative services.

Factor 3 identifies the significance of access to capital, financial advice (possibly obtained from business LINKS), and public training contributed by TECS. Like premises, capital is an essential factor of production both for firms in general and innovative activities in particular. We are conducting other analyses on the characteristic sources of capital for innovation in the LMR but these are not yet completed and so are not reported here.

In addition to the product life cycle model (Vernon 1966), and the urban assets Coase (1937) and Williamson (1985) explanation of the economic advantages of metropolitan urban areas for innovation, a third possibility for explaining the importance of urbanisation effects is offered by the idea of "innovative milieu". Here it is argued that an explanation of high-technology agglomeration is that networks are a key vehicle particularly of their untraded interdependences (Aydalot 1986, Aydalot and Keeble 1988, Crevoisier and Maillat 1991, Hall 1990, Maillat et al 1993, Storper 1991).

Table 5: Qualifications of resident London Region workforce
2% Individual SAR

Characteristic	Inner London	Outer London	Rest of SE	Rest of GB
Qualification Level				
Level a	2.3	1.4	1.1	0.7
Level b	12.7	8.3	7.1	5.1
Level c	5.1	5.7	6.7	6.1
No qualification	80	84.7	85.1	88.1
Subject Group of Highest Qualification				
Education	1.1	1.4	1.8	1.9
Health/Medicine/Dentistry	2.5	2.4	2.4	2.4
Technology/engineering	1.6	2.1	3	2.2
Agr/forestry/veterinary	0.1	0.1	0.2	0.2
Science & maths	2	2	2	1.3
Soc/admin/business	6.6	4.3	3.3	2.3
Vocational studies	0.9	0.5	0.5	0.4
Language studies	2.1	1.1	0.8	0.5
Arts	1.4	0.6	0.5	0.4
Music/drama/visual arts	1.6	0.7	0.5	0.3
Not stated	0.1	0.1	<0.1	<0.1
Total population 16+yrs=100%	36187	64560	162928	582653

Source:

In this third explanation, face-to-face contacts are required within cities. This is either because the first introduction of innovative products is highly dependent on complex communication; or because local innovation arises in the context of dense communication networks and the exchange of knowledge in the form of untraded interdependences. These represent "soft" kinds of infrastructure as compared with "hard" transportation and communication systems.

In an innovative milieu it is argued that knowledge is accumulated in a socialised way outside firms. It becomes an external urban asset to firms located in such a milieu. Elements are appropriated by individual firms by continual adjustments based on trust and interdependence. Services form part of this process of external knowledge accumulation.

Factor 2 indicates that traded specialised and general business knowledge and information make important contributions to innovation in the LMR. The variables grouped in this factor include private traded business services. Tables 2 and 4 have already shown the concentrations of these kinds of employment and qualifications in the LMR. The relative significance of these traded services compared with the harder to identify untraded interdependences remains a question for further empirical analysis.

Nevertheless, traded business services and consultancies make up part of the urban assets of any given city. They are an important element of the learning environment in which manufacturing innovation takes place. One of their functions is to put together creatively new packages of information and knowledge to form the bases of innovative departures. They form part of the knowledge assets of particular cities.

The anonymity of large metropolitan areas like the LMR combined with their high density of traded business services may help the trial and error process of innovation. This may take two main forms. On the one hand, high firm birth and death rates also accommodate the trial and error nature of some innovations. The ability to fail and try again is a significant element of creative destruction. It may also be a phenomenon which distinguishes more innovative from less innovative cities.

On the other hand, lower transaction costs may give marginal economic activities have a better chance to survive when these are located in large agglomerations. Therefore, agglomeration advantages benefit not only strong firms, but also and especially marginal, less organised firms and firms in local and regional markets that are characterised by uncertainty.

Core metropolitan regions may therefore both aid the incubation of more novel innovations and nurture the more marginal firms and to the firms operating in more uncertain innovative project markets. There may therefore be economic grounds for supporting both an incubation and a protection hypothesis for new innovative firms in core metropolitan regions.

4 Globalisation effects

We have not yet had time to analyse the possible globalisation effects connected with innovation in the LMR. They are expected to be highly significant. The high proportions of exports of innovations from the interviewed firms makes it highly likely that one of the key features of the LMR is its position as an international trading node in the global economy. The relationships between the local and the global will form an important part of our work on the database.

Summary and conclusions

This paper represents some very early findings from an as yet incomplete database. Our four collaborating European partners are due to make their contributions to this database this month. Any conclusions at this stage must be highly tentative. To some extent they are based on the informal discussions that have been taking place with our colleagues since the start of the project.

Looking at the analyses from the London perspective we find that, with regard to innovative projects developed in the LMR, traditional urbanisation effects are still strong reasons for locating there. Regional transportation systems and effective accessibility are re-iterated as key factors in where firms decide to locate their activities.

In addition to these, premises (land), labour and capital also emerge as important factors in decisions to locate innovative projects in the LMR. Restrictions on the availability of land and hence suitable premises are imposed by the planning system. Respondents have therefore raised the issues of both their cost and availability.

On the other hand highly qualified professional and technical labour is to be found in the LMR. Without this factor innovation would be difficult if not impossible. Capital and advice on sources are also available in the LMR.

Contrary to notions of untraded interdependences found in the concept of innovative milieu, the availability of traded general and specialised business services plays an important role in providing the urban assets used by innovative firms. These are one of the major specialisations of the South East.

The evidence reviewed so far suggests that urbanisation effects are more significant than localisation effects in the LMR. It is hard to find empirical evidence of functioning clusters among the most innovative sectors as identified in the CIS. For a minority of firms local industrial knowledge and experience are important. There is also some evidence of the use of local suppliers and the importance of locating near to local customers. As far as we can tell at the moment, this evidence does not add up to support for the existence of industrial districts nor the development of clusters according to any strict definition of that term.

We shall be turning our attention to globalisation effects next. We do expect that these will form a strong part of the explanation for the location of the most innovative and export oriented firms in the LMR. The connections between local production on the one hand, and global markets for the most novel innovations on the other is expected to be a defining characteristic of London's innovative activities.

References

Aydalot, P. (1986) Milieux Innovateurs en Europe, GREMI, Privately Printed, Paris.

Aydalot,P; Keeble,D Eds. (1988): High Technology Industry and Innovative Environments; The European Experience. Routledge, London.

Camagni,R (1991) "Introduction", in Camagni, R. ed. Innovation Networks: Spatial Perspectives, London, Belhaven-Pinter.

Coase, R. H. (1937) "The nature of the firm", Economica, pp. 386-405.

Crevoisier, 0. and Maillat, D. (1991) "Milieu, industrial organization and territorial production system: towards a new theory of spatial development", in Carmagni, R. ed. Innovation networks: Spatial Perspectives, London, Belhaven Press.

Decoster, E; Tabaries, M (1986): I'Llinnovation dans un pole scientifique: le cas de la Cite Scientifique Ile de France Sud", in Aydalot, P (ed) Milieux Innovateurs en Europe, 79-100, GREMI, Paris.

Hall, P. (1990) "The generation of innovative milieux: an essay in theoretical synthesis", Working Paper 505, Berkeley, Institute of Urban and Regional Development, University of California.

Hart, D. and Simmie, J. M. (1997) "Innovation, competition and the structure of local production networks: initial findings from the Hertfordshire project", Local Economy, November, pp. 235-246.

Jacobs, J. (1968) The Economy of Cities, London, Weidenfeld.

Maillat, D., Quevit, M. and Senn, L. (1993) eds. Reseaux d'lnnovation et Milieux Innovateurs: Un Pari pour le Developpement Regional, Neuchatel, GREMI.

Manshanden, W. and Poot, T. (1998) Innovation in Noord-Holland; Profile of a Province, Research commissioned by the province Noord-Holland, Amsterdam, Foundation for Economic Research of the University of Amsterdam.

Manshanden, W. (1998) Supply and Demand of Knowledge in Noor-Holland, Methodology Results Conclusions, Research commissioned by the province Noord-Holland, Amsterdam, Foundation for Economic Research of the University of Amsterdam.

Oakey, R. P. (1981) High Technologv and Industrial Location, Aldershot, Gower.

Perrin,J (1988) Comment Naissent les Techniques? Publisud, Paris.

Poot, A.P., Brouer, N.M., Ouwersloot, J. and Rietveld, P. (1997) Innovatie in de regio; provinciale innovatieprofielen, Amsterdam, Stichting voor Economisch Onderzoek, in opdracht van het Ministerie van Economische Zaken.

Rabellotti, R. (1995) "Is there an 'industrial district model'? Footwear districts in Italy and Mexico compared". World Development, 23(1), 29-41.

Simmie, J. M. (1998a) "Innovate or stagnate: economic planning choices for local production nodes in the global economy", Planning Practice and Research, Vol. 13, No. 1, pp. 35-51.

Simmie, J. M. (1998b) "Reasons for the development of "Islands of innovation". Evidence from Hertfordshire", Urban Studies, Vol. 35, No. 8, pp. 1261-1289.

Storper,M (1991) "Technology districts and international trade: the limits to globalisation in an age of flexible production", Graduate School of Urban Planning, UCLA.

Teece, D. (1988) "Technological changes and the nature of the firm", in Dosi, G. et al eds. Technical Change and Economic Theory, London, Pinter, pp. 256-281.

Vernon, R. (1966) "International investment and international trade in the product cycle", Quarterly Journal of Economics, 80, pp 190-207.

Wiig, H and Wood, M (1996) "What comprises a regional innovation system? Theoretical base and indicators", Chpt 5, pp. 66-98 in Simmie, J. M. ed Innovation, Networks and Learning Regions?, London, Jessica Kingsley.

Williamson, 0. E. (1985) The Economic Institutions of Capitalism, New York, Free Press.